EXCESS MORTALITY IN COUNTRIES IN THE PACIFIC AREA

Kazuo UEMURA

Summary

For the assessment of the magnitude of preventable mortality in a population two statistical indicators have been proposed by this author in a previous article, based on the comparison of its mortality level with the lowest age-sex-specific death rates recorded among countries. The present paper applies one of them, namely the proportional excess mortality, to the statistical data from countries in the Pacific Area. The existence of large differences in the excess mortality level among countries is revealed according to this indicator, pointing to the potential for a substantial reduction in mortality through the application of the available health technology and the promotion of cleaner environment and healthy lifestyles of people.

1. Excess mortality

Statistical measurement of the level of health of a population has long been an important subject of study both in public health in particular and in the assessment of the standard of living in general. In recent years an increasing emphasis has been placed on the development of methodology for measuring morbidity and disablement in the population and on the search for "positive" health indicators such as those on nutrition, and physical and mental performance (Abelin et al., 1987). Some indicators, especially on nutrition, are already in use in national and international health monitoring and evaluation (World Health Organization, 1993). Nevertheless, mortality indicators continue to be used because of the availability of reliable statistical data in countries or in communities in which a death registration system has been well established. In any case, death is the most extreme event of ill health, and consequently, mortality indicators are particularly relevant when they reflect the magnitude of preventable deaths in the population.

A few different approaches have been proposed to the measurement of avoidable mortality. For instance, the one proposed by Rutstein uses a list of unnecessary diseases, disabilities and untimely deaths, established in the light of the medical and health technology currently available (Rutstein, 1976). A similar method was adopted by the European Community and a useful atlas

Table 1 Lowest age-sex-specific death rates (per 100 000 population) registered in the world since 1950

Age	Male			Female		
	Death rate	Country(Year)		Death rate	Country(Year)	
Under 1	487	Japan	(1989)	430	Japan	(1989)
1 - 4	22.6	Sweden	(1984)	20.7	Sweden	(1981)
5 - 9	14.6	Scotland	(1989)	10.1	Finland	(1986)
10 - 14	14.2	Sweden	(1982)	8.0	Norway	(1988)
15 - 19	53.3	Netherlands	(1986)	21.0	Ireland	(1975)
20 - 24	73.7	Netherlands	(1988)	26.7	Ireland	(1986)
25 - 29	65.8	Netherlands	(1987)	27.2	Ireland	(1985)
30 - 34	81.8	Netherlands	(1982)	42.0	Norway	(1979)
35 - 39	104	Ireland	(1988)	64.1	Norway	(1987)
40 - 44	180	Albania	(1988)	92.4	Albania	(1987)
45 - 49	309	Japan	(1989)	148	Greece	(1988)
50 - 54	520	Greece	(1987)	259	Japan	(1989)
55 - 59	882	Japan	(1982)	385	Japan	(1989)
60 - 64	1266	Japan	(1986)	576	Japan	(1989)
65 - 69	1960	Japan	(1989)	954	Japan	(1989)
70 - 74	3397	Japan	(1987)	1727	Japan	(1989)
75 - 79	5758	Japan	(1989)	3207	Japan	(1989)
80 - 84	9888	Japan	(1989)	6217	France	(1988)
85 +	16133	Yugoslavia	(1964)	13788	USA	(1979)

has been constructed on the level of avoidable mortality in the countries of the European Community (Holland, 1988). The method is a valid one for countries where reliable information is available on causes of death. However, this is not the case in many of the developing countries, in which a death may not be attended by a physician, and, even when a medical certificate is established, the diagnosis recorded may often be vague or ill-defined.

The author has proposed the assessment of excess mortality by using the lowest age-sex-specific death rates recorded among countries of the world as a reference (Uemura, 1989). In computing excess mortality, the reference ("standard") death rates are applied to the age-sex composition of the population of a given country to obtain the number of deaths which would have occurred under the lowest mortality pattern; the expected number is then subtracted from the actual number of deaths recorded in the country to yield the excess.

Two indicators were defined for this purpose, viz., the excess mortality ratio (EMR) and the proportional excess mortality (PEM), as follows:

$$EMR = 100\,(D - D_s)/D_s$$
$$= 100\ \Sigma\Sigma P(i,j)\ m(i,j)/\ (\Sigma\Sigma P(i,j)\ m_s(i,j)) - 100$$

Table 2 Proportional excess mortality in countries in the Pacific Area

Country	Year	Male	Female	Both sexes
		%	%	%
USSR	1988	55.7	49.4	52.4
China (Rural)×	1989	46.2	55.2	50.3
(Urban)×	1989	34.3	48.1	40.5
Rep. of Korea	1987	49.9	38.8	45.4
Japan	1989	2.8	1.5	2.2
Thailand	1980	58.8	60.7	59.6
Singapore	1987	36.4	43.7	39.6
Australia	1988	22.2	19.7	21.0
New Zealand	1987	31.7	33.5	32.6
Canada	1988	21.2	16.0	18.8
USA	1988	27.1	23.1	25.1
Mexico	1986	50.9	56.0	53.1
Guatemala	1984	72.4	80.7	76.2
El Salvador	1984	60.7	59.5	60.2
Honduras	1981	57.2	67.0	61.5
Costa Rica	1988	35.6	42.6	46.6
Panama	1987	26.7	41.6	33.0
Colombia	1984	51.6	57.6	54.2
Ecuador	1988	52.6	61.8	56.7
Peru	1983	49.0	64.5	56.4
Chile	1987	40.1	44.2	42.0

×Selected areas.

and

$$PEM = 100\,(D - D_s)/D$$
$$= 100\ EMR\ /\ (100 + EMR),$$

where

D = Observed number of deaths

D_s = Expected number of deaths under the "standard" mortality pattern

i = Age group number

j = Sex group number

$P(i, j)$ = Population in age group i and sex group j

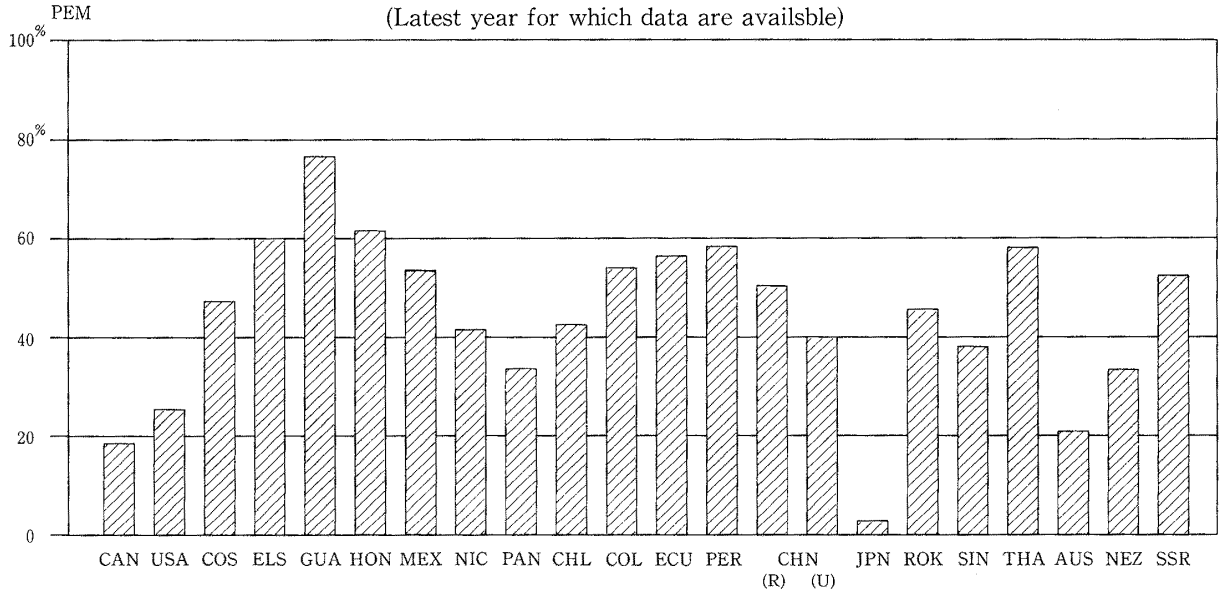
$m(i, j)$ = Observed death rate in age group i and sex group j

$m_s(i, j)$ = Expected death rate in age group i and sex group j under the "standard" mortality pattern,

and the summation symbol $\Sigma\Sigma$ refers to all values of i and j.

The two indicators are logically equivalent, since they are related to each other, as seen in the above formula for PEM. Alternatively,

Fig. 1
PROPORTIONAL EXCESS MORTALITY
(Latest year for which data are availsble)



EMR = 100 PEM / (100 − PEM)
also holds.

The indicator EMR shows how high the actual mortality is in comparison with the standard, while the PEM indicates what proportion of the actual mortality is in excess of the standard. In the usual epidemiological terminology, the EMR is a standard mortality ratio, i. e., an indirectly standardized death rate.

In the previous paper quoted above the EMR was primarily used because of its epidemiological significance. In the present paper, however, the PEM is used particularly for its easy interpretation, and hence its appeal to policy makers. The PEM provides an indication of the proportion of the deaths occurring in the population that may have been prevented by means of the currently available health technology and through the promotion of cleaner environment and healthier lifestyles.

2. Excess mortality in countries in the Pacific Area

The lowest mortality observed in the world is shown in Table 1, based on the data reported by countries to the WHO's data bank (World Health Organization, 1992). In children and young adults, the lowest mortality has been observed mainly in countries of Northern and North-Western Europe, while in middle and older age groups it has been recorded in Japan and

Fig. 2
TRENDS IN PROPORTIONAL EXCESS MORTALITY. (1)
Northern and Central America.

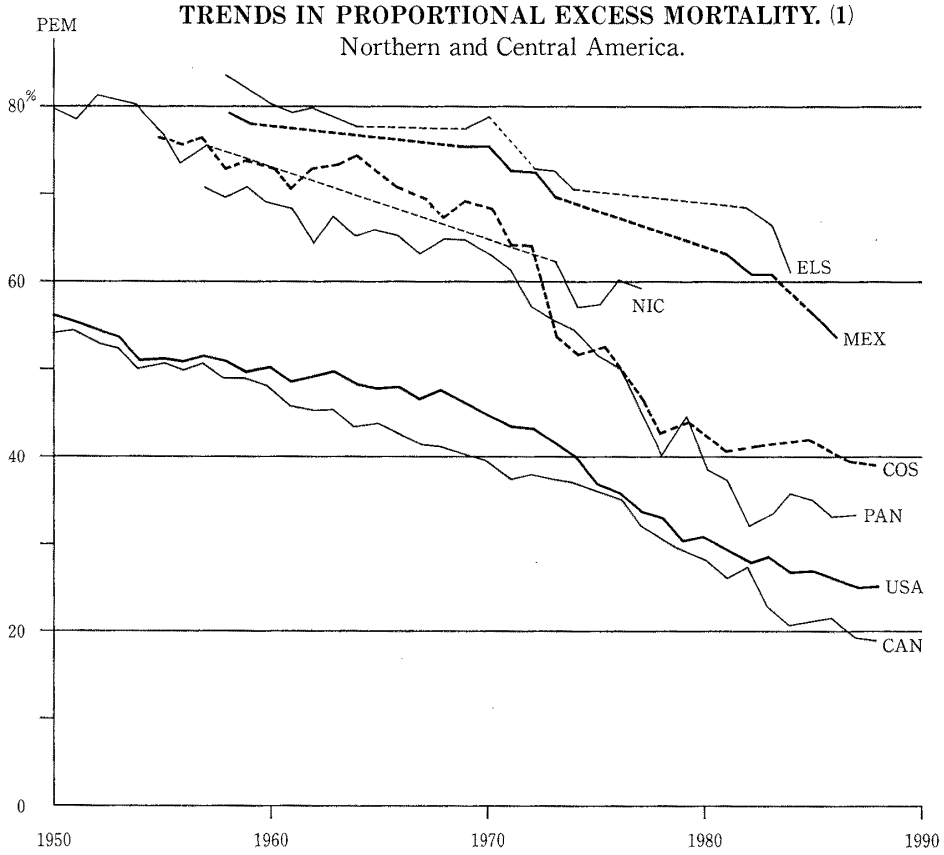


Fig. 2
TRENDS IN PROPORTIONAL EXCESS MORTALITY. (2)
Southern America.

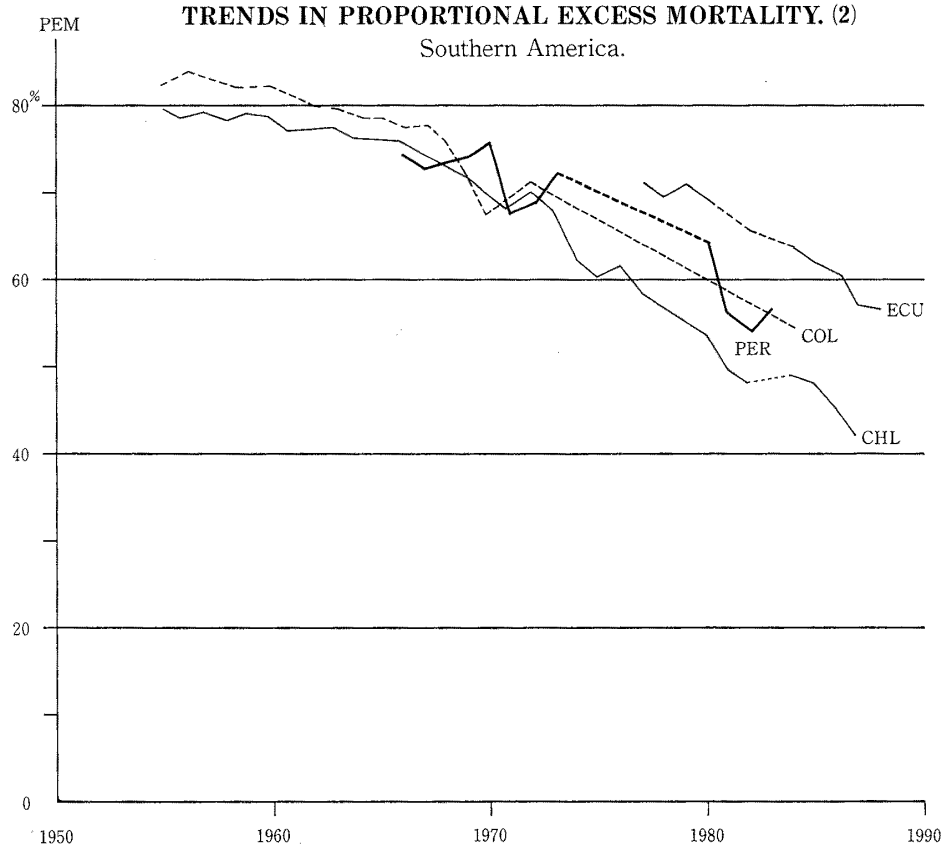


Fig. 2
TRENDS IN PROPORTIONAL EXCESS MORTALITY. (3)
Eastern and South-Eastern Asia.

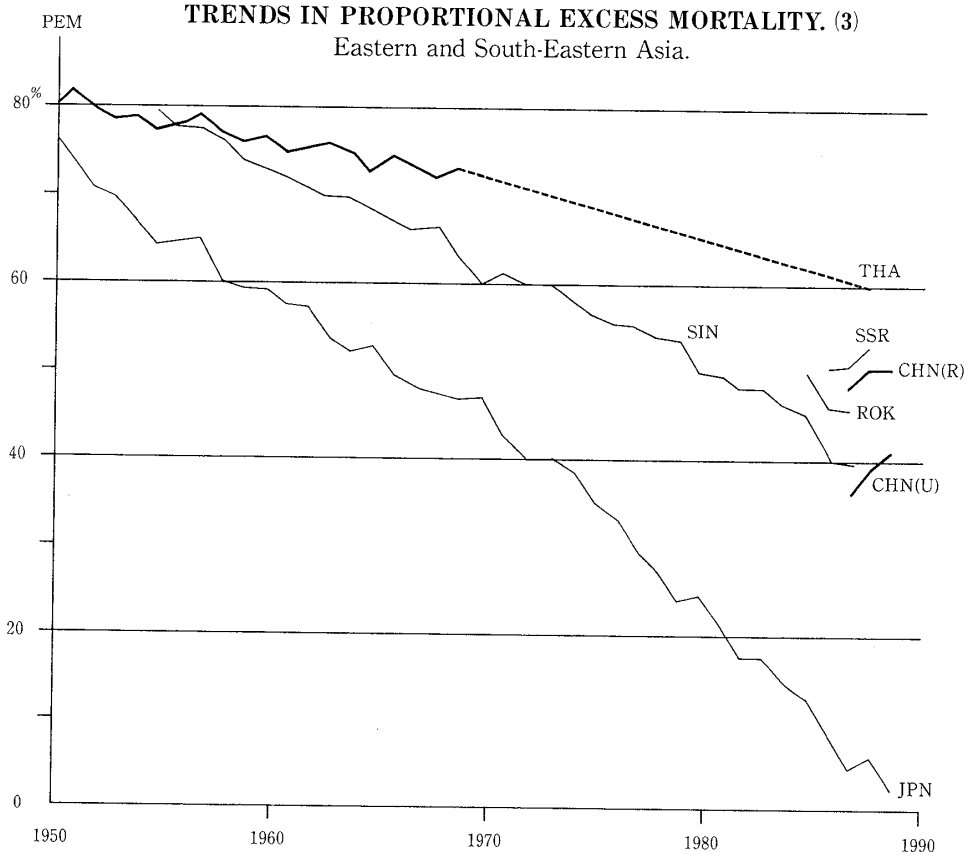


Fig. 2
TRENDS IN PROPORTIONAL EXCESS MORTALITY. (4)
Oceania.

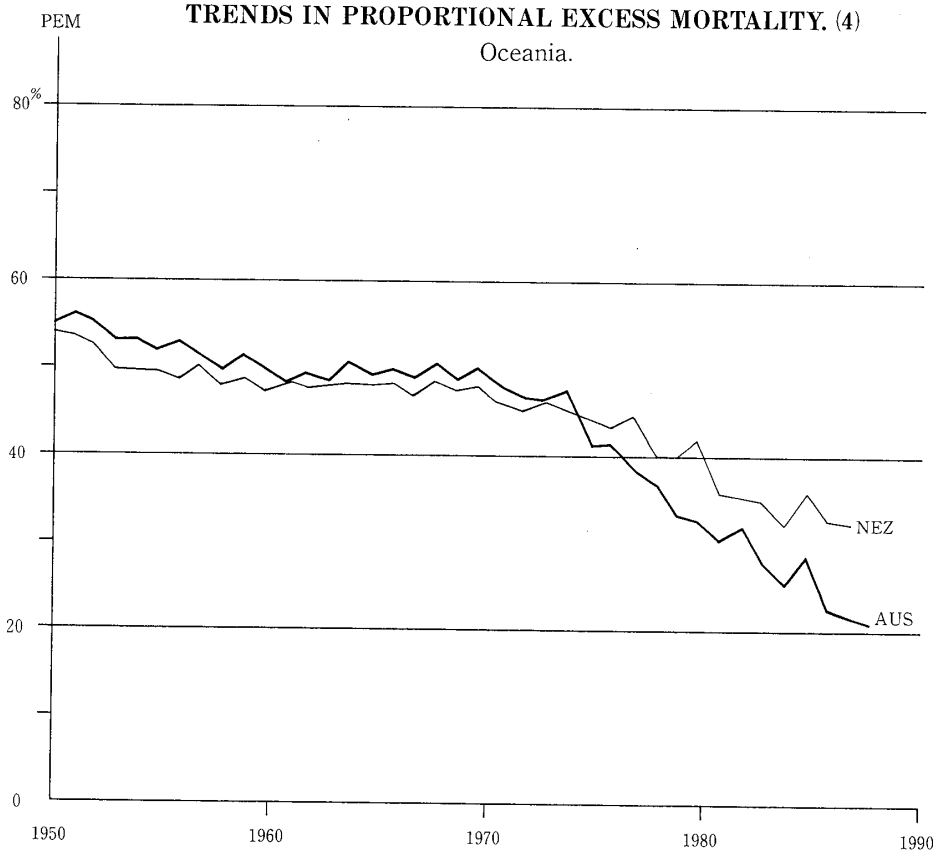
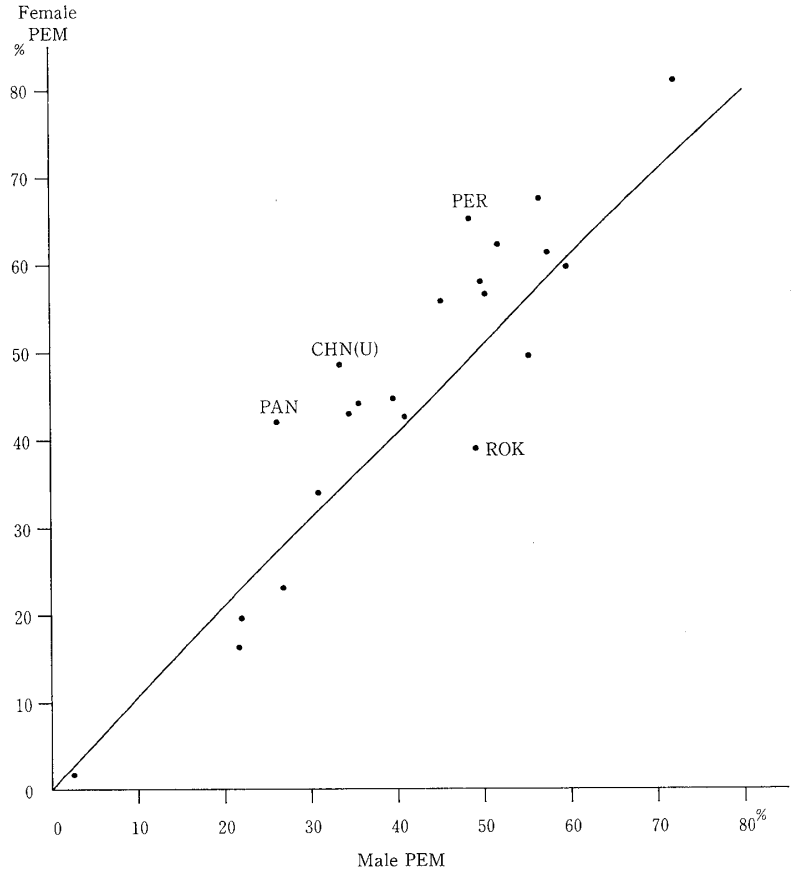


Fig. 3
RELATION BETWEEN MALE AND FEMALE PROPORTIONAL MORTALITY



in some countries in South-Eastern Europe.

Table 2 and Figure 1 show the PEM for countries in the Pacific area, computed for the latest year for which data are available. The PEM reaches as high as 60% or more in Thailand and several countries in Latin America. On the other hand, in most of the industrialized countries in this area the PEM is in the range of 20-30%. Japan is an exceptional case for which the PEM has dropped to a very low level. The fact that the Japanese mortality is the lowest in the world in age groups 55-84 years as seen in Table 1 seems to point to their relatively healthy lifestyles, perhaps especially with regard to the dietary habits.

The trends observed in the PEM in the countries over the last four decades are shown in Figures 2(1)-2(4), comparing countries in (1) Northern and Central America, (2) Southern America, (3) Eastern and South-Eastern Asia, and (4) Oceania, respectively. In all countries the PEM has been on a steady decline, though the speed varied among countries. In several countries the decrease has been more rapid since the 1970s. The trends in Japan are again particularly noteworthy. Its PEM was over 70% in 1950, which was in fact the highest of all industrialized countries in the world at that time. Successful control of tuberculosis, which was then the leading

cause of death in the country, and other infectious diseases through improved medical care and effective public health measures has no doubt contributed substantially to the rapid decrease of the PEM in the 1950s and 1960s. Furthermore, vigorous campaign against hypertention during the subsequent years promoting a reduction of salt intake and effective blood pressure control has brought down mortality from cerebrovascular disease which took over the leading position on the country's list of causes of death from tuberculosis in 1951 and remained as the major killer disease until 1980.

3. Excess mortality by sexes

The PEM may be computed separately for subgroups of a population, such as age and sex groups. Comparison of the PEM between sexes reveals a general tendency for its value to be higher in females than males, as seen in Figure 3. The difference is considerable in Peru, Panama and China, most probably reflecting an unfavourable health environment for females in those countries. A further look into the PEM in relation to age in each sex group reveals that higher female excess mortality occurs not only in the reproductive age groups, but throughout the life span. On the other hand, the PEM is somewhat higher in males than females in the Republic of Korea. The age breakdown of the PEM shows that the value is higher in females than males under 30 years of age but the relationship is reversed in higher ages. Further study of the causes of death in these countries, if available, in the age-sex groups with a high PEM will indicate what action is needed to reduce its level.

Acknowledgement

The author wishes to express his great appreciation of the help kindly provided by Dr. A. Lopez and Mr. M. Bunzel of the World Health Organization, Geneva, Switzerland in data handling for the preparation of this paper.

References

Abelin, T., Brzezinski, Z. J. and Carstairs, V. D. L. , eds., *Measurement in Health Promotion and Protection* (WHO Regional Publications, European Series No. 22). World Health Organization, Copenhagen, 1987.

Holland, W. W. ed., *European Community Atlas of Avoidable Death* (Commission of the European Communities, Health Services Research Series No. 3). Oxford University Press, Oxford, 1988.

Rutstein, D. D. et al., *Measuring the Quality of Medical Care: A Clinical Method*. New England Journal of Medicine, 294, 1976, P.582-588.

Uemura, K., *Excess Mortality Ratio with Reference to the Lowest Age-sex-specific Death Rates*

among Countries. World Health Statistics Quarterly, 42, 1989, P.26-41.

World Health Organization, World Health Statistics Annual 1992, Annex I, Geneva

World Health Organization, *Implementation of Global Strategy for Health for All by the Year 2000 : Second Evaluation. Eighth Report on the World Health Situation*. Vol. 1, Geneva, 1993, P.164.